NESTING BIOLOGY OF BROAD-WINGED HAWKS IN WISCONSIN

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Abstract — Seventy-two nestings in 56 Broad-winged Hawk (*Buteo platypterus*) nesting areas were investigated in Wisconsin from 1976 through 1981. Trembling aspen (*Populus tremuloides*) and white birch (*Betula papyrifera*) supported 51% and 29% of all nests, respectively. A reoccupancy rate of 0.60 was found for 16 nesting areas. Mean distances between nests on an intensive study area were 1.5 km (1976; n=9), 1.7 km (1980; n=9), and 1.1 km (1981; n=10). Density in 1981 on 23.7 km² was 1/2.4 km². Means of 2.4 eggs laid, 1.8 hatched, and 1.5 young fledged were found for 70 active nests. Fifty-five of 70 (79%) nests fledged young. The major factors reducing productivity occurred before hatching.

Relatively little has been published on the nesting ecology of the Broad-winged Hawk (*Buteo platypterus*). There are few productivity and density data for this common breeding raptor of North America's eastern deciduous forests. The first review of Broad-winged Hawk biology by Burns (1911) was general, though extensive. Recent studies of various aspects of Broadwing nesting ecology have reported data from relatively few nests: Rusch and Doerr (1972) 5 nests in Alberta; Fitch (1974) 3 nests in Kansas; and Matray (1974) 14 nests in New York. Keran (1978) presented habitat data from 29 nests in Minnesota and Wisconsin. Intensive studies of nest habitat by Titus and Mosher (1981), and nesting biology by Janik and Mosher (1982) are based on 24 and 36 nests, respectively, in Maryland. This paper presents data from 72 Broad-winged Hawk nests in Wisconsin from 1976 through 1981. The objectives of my study were to determine the spacing of nests, density of nesting pairs, and productivity.

Study Area and Methods

In 1976, 1980, and 1981, I intensively searched for Broadwing nests in an area approximately 1.6 km north of Merrill, Wisconsin, 45°10′ lat 89°40′W long. Here, I did not establish study area boundaries and completely search the interior in 1976 and 1980; instead, I conducted an intensive nest search and then established a boundary around the area I was able to inventory, resulting in 18.1 km² and 17.5 km², respectively (Fig. 1). In 1981 I established a 23.7 km² study area prior to nest searching (Fig. 1). I am confident that I found all Broadwing nests on the Merrill study area in 1976, 1980, and 1981 (Fig. 1).

In 1977 through 1979 I searched for nests in areas similar to known nest habitat within 10 km east, west and north of the Merrill study area; in 1977 through 1981 I revisited known nesting areas to determine reoccupancy. Nests were also found incidental to other research on the Nicolet National Forest, 120 km northeast of Merrill, and on 2 other areas, one 266 km south and another 190 km northwest of Merrill, respectively. Calling Broad-winged Hawks led me to nesting areas; fresh greenery on nests indicated recent use.

The 1981 Merrill study area was nearly level, ranging from 399 to 412 m in elevation. Its habitat included 39% upland hardwoods, 36% farmland, 10% alder (*Alnus rugosa*) thicket, 8% bog, 2.5% permanent water, 2.5% residential, 1.2% swampland, and 0.7% red pine (*Pinus resinosa*) plantation. Ground moraine soils were poorly drained, and small (2-10 m²) woodland pools of water were common throughout spring and summer. The typical upland hardwood was trembling aspen (*Populus tremuloides*) which existed in pure stands or mixed with white birch (*Betula papyrifera*) and balsalm fir (*Abies balsamea*). Black ash (*Fraxinus nigra*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*) were common in permanently wet areas.

An active nest or nesting attempt was one in which eggs were laid; an occupied nest was one in which 2 adults were present near a recently constructed nest with fresh greenery on top (Postupalsky 1974). A nesting area was that area within a radius of 250 m of a nest. A nesting area was considered reoccupied if, in subsequent years, an active or occupied nest was found within 250 m of a previously used Broad-winged Hawk nest, or if a nest was reused by Broadwings.

Mean distances between nests on the Merrill study area were determined in 1976, 1980, and 1981 in the manner reported by Reynolds and Wight (1978). Productivity was determined by climbing to each active nest once during mid-to-late incubation and again about 2 w later to record the clutch size and the number of nestlings, respectively. I returned to nests to determine fledging rates when I estimated young to be > 30 d old.

Results and Discussion

I found 70 active and 2 occupied Broad-winged Hawk nests; 28 by intensive searching, 12 by searching habitat similar to known nest habitat, 17 by revisiting nesting areas in subsequent years, and 15 as incidental finds. Broad-winged Hawks nest in a variety of hardwood tree species across their breeding range. The majority of nests in my study were supportged by trembling aspen (51%) and white birch (29%). Matray (1974) reported 86% of 14 nests in yellow birch (*Betula alleghaniensis*) in New York. In Maryland, Titus and Mosher (1981) found 79% of 24 nests in various oaks, predominantly white oak (*Quercus alba*) (50%). Burns (1911: 246) reported American chestnut (*Castanea dentata*) as the most "popular" nest tree in the northeastern United States. Keran (1978) reported 21% of 29 nests in Minnesota and Wisconsin in aspen and 41% in oak. Diameter at breast height and height of nests in trees in my study were less than those reported in other studies (Table 1).

Table 1. Comparison of diameter at breast height (DBH) of nest trees and height of Broad-winged Hawk nests ($\bar{X}$ ± S.D., (range)).

Source	N	DBH	Nest Height (M)
This study	72	31.5 ± 6.3 (21.1 - 48.8)	8.2 ± 2.7 (3.9 - 15.4)
Burns (1911)	167	-	10.1
Matray (1974)	14	54.1 ± 8.3 (42.1 - 74.2)	13.3 ± 1.4 (11.0 - 15.5)
Titus and Mosher(1981)	24	38.0 ± 9.5 (25.0 - 62.0)	13.7 ± 3.0 (9.5 - 20.6)

Twenty-nine of 56 (52%) Broad-winged Hawk nesting areas in this study contained 1 or more other stick nests. This suggests that a nest area, not just a nest tree, has some important characteristics, such as the interspersion of habitat types, that may be related to the high nesting density (see below). The importance of certain areas for nesting is further indicated by the reoccupancy rate. I revisited 16 nesting areas (including nest areas on the Merrill study area) 47 times in subsequent years and

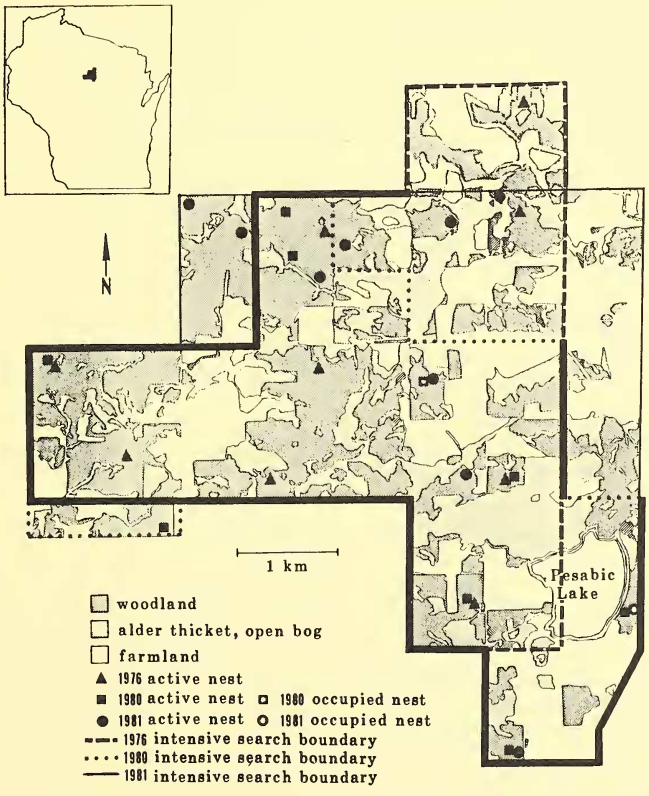

Figure 1. Distribution of Broad-winged Hawk nests on the Merrill, Wisconsin study area. Thickened line indicates where 2 or more years formed the study area boundary.

found them reoccupied on 28 occasions, resulting in a reoccupancy rate (number reoccupied/number revisited) of 0.60. Broadwings usually built a new nest in a different tree in a reoccupied nesting area. Broad-winged Hawk nests were reused on only 5 occasions; 3 the next year, 2 the second year.

Mean distances between nests on the Merrill study area were: 1976-1.5 km (range = 1.1-2.2 km, SD = 0.37 km), 1980-1.7 km (range = 0.6-3.1 km, SD = 0.72 km), and 1981-1.1 km (range = 0.5-2.4 km, SD = 0.62 km). The smaller mean distance in 1981 was due to the close spacing of the 6 most northerly nests (Fig. 1) that were in locally wet areas.

Density on the Merrill study area in 1981 was 1 pair/2.4 km². Variously derived densities in other studies were a maximum of 1 pair/23.3 km² estimated by Rusch and Doerr (1972) in Alberta, 1 pair/5.2 km² estimated by Burns (1911: 176) in Massachusetts, and 1 pair/2 mi² (this converts to 5.2 km² rather than 3.2 km² as stated) reported by Keran (1978) in Minnesota. Wisconsin density is high when compared to other studies.

I suggest that the relatively high density of nesting Broad-winged Hawks in 1981 is related to the interspersion of habitat types on the Merrill study area, which lies between extensive northern forests and an intensively farmed central region of Wisconsin. The partial conversion of forests to farmland in this area has created more upland openings and edge habitat than were originally present. Keran (1978) suggested that such openings may be important to nesting Broad-winged Hawks because they are utilized as primary hunting sites. Fuller (1979) found Broadwings in field-forest edge more than would be expected by chance when this habitat type occurred in their home ranges. Further, 5 of 6 Nicolet Forest nests were within 50 m of roadways, which perhaps served as primary hunting sites in an extensively forested area. Titus and Mosher (1981) indicated that Broad-winged Hawks nested closer to both water and forest openings than would be expected by chance. Matray (1974) stated that Broadwings seemed to prefer nesting on poorly drained sites. The importance of wet areas is suggested by the close spacing of the aforementioned 6 nests which corresponded with the occurrence of wet habitat in the Merrill study area.

Means of 2.4 eggs laid, 1.8 hatched, and 1.5 young fledged per nest attempt were found in this study (Table 2). A one-way analysis of variance revealed no significant ($P > 0.05$) differences among the yearly means, even though there was considerable variability. Janik and Mosher (1982) reported Broad-winged Hawk productivity data for a 3 y study in Maryland, but they did not report yearly means. I do not know if the annual fluctuations found in my study are common for the species or if they are a function of the relatively small number of nests analyzed each year.

Table 2. Mean number of eggs laid, hatched and young fledged per nest attempt[1].

Year	N	Eggs laid[2]	Eggs hatched	Young fledged
1976	9	2.2	1.9	1.8
1977	10	2.0	1.3	1.1
1978	14	2.3	1.9	1.7
1979	12	2.3	1.7	1.3
1980	10	2.5	2.1	1.5
1981	15	2.6	2.0	1.7
Total	70	2.4	1.8	1.5

[1]A nest attempt was one in which eggs were laid.
[2]The distribution of clutch sizes was 2 clutches of 1 egg, 43 of 2, 23 of 3, and 2 of 4.

Fifty-five of the 70 (79%) active nests fledged young. The major factors that decreased Broad-winged Hawk productivity occurred before hatching (38 eggs were lost compared to 20 young). I could not determine the cause of all egg and nestling losses, but I suspected mammalian predation of 4 eggs (2 nests) and of 6 nestlings (5 nests), and avian predation of 3 eggs (1 nest). Destruction of 2 nests by windstorms caused the loss of 2 eggs and 3 nestlings. My extended visit may have caused a female to desert another nest with 3 eggs. The incubating adult at 1 nest may have kicked 1 of 2 eggs out of the nest cup, as an ejected egg was found embedded within the nest structure. Fifteen (14 nests) of the 165 eggs laid, including 2 complete clutches, did not hatch for unknown reasons. The cause of loss of 10 eggs (6 nests) and 11 nestlings (10 nests) was unknown. Suspected predators of Broadwing nests were the Raccoon (*Procyon lotor*) and Common Crow (*Corvus brachyrhynchos*).

My study further supported the importance of both woodland openings and wet areas to Broadwing nesting habitat. Wisconsin productivity data provide some basis for understanding the popula-

tion dynamics of Broad-winged Hawks. However, the number of young produced in any one year that is necessary to maintain a stable population is a factor of the age structure and mortality rates of nesting adults (Henny and White 1972). Such data do not exist for the Broad-winged Hawk. Future studies should include long-term trapping and marking of breeding adults to determine age structure and turnover rate of nesting populations.

Acknowledgments

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Anderson Award. The 2nd annual William C. Anderson Award for the best student paper was presented at the 1983 Raptor Research Foundation meeting in St. Louis, Missouri. The winner was Mr. Jim Duncan of the MacDonald Raptor Research Center, McGill University. Jim's paper was entitled "Mate Selection in Captive Kestrels: I. Siblings vs. Strangers."

Students wishing to be considered for the 1984 ANDERSON AWARD must indicate their eligibility when submitting abstracts. Eligibility criteria were published in *Raptor Research* 16(1):30-32. Questions regarding the 1984 award should be directed to: Dr. Robert Kennedy, Director, Raptor Information Center, National Wildlife Federation, 9412 16th Street, NW, Washington, D.C. 20036.

Attention RRF Members Past and Present!! The Raptor Research Foundation, Inc., is approaching its 20th Anniversary. In honor of this memorable occasion, I am compiling a twenty-year history of the Foundation to be presented in Sacramento at the 1985 annual meeting. In addition, plans are to compose a monograph detailing the Foundation's history from beginning to present. I request the assistance of you, the membership, both past and present, in accomplishing this task. Please contact me if you have any pertinent information in your files, such as photographs, correspondence, etc., that you would be willing to loan to me. All such material will be acknowledged in publications, of course, and I will make copies of the materials for my use and return the originals immediately. If you have anything you wish to contribute, please contact me as follows: Jimmie R. Parrish, Department of Zoology, 159 WIDB, Brigham Young University, Provo, Utah 84602, USA.